REMARKS

The office action of February 7, 2008 has been reviewed and its contents carefully noted. Reconsideration of this case, as amended, is requested. Claims 7 through 12 remain in this case, claims 13-18 being cancelled and claims 7 and 12 being amended by this response. No new matter has been added. More specifically, the amendments to claims 7 and 12 are fully supported by page 18 line 27 through page 19, line 19 and page 21, lines 5-12 of the application, as filed. The Applicant reserves the right to pursue claims 13-18 in one or more divisional applications.

The numbered paragraphs below correspond to the numbered paragraphs in the Office Action.

Restriction Requirement

1. The Examiner has made a restriction requirement and has identified four groups as follows:

Group I - recited in claims 7-12.

Group II - recited in claims 7-11 and 13-14.

Group III - recited in claims 15-17.

Group IV - recited in claim 18.

During the phone interview the Applicant's attorney told the Examiner that Group I would be elected for further prosecution without a traverse of the requirement. The election of Group I is confirmed.

Rejections under 35 U.S.C. §102

6. Claims 7-10 and 12 were rejected under 35 U.S.C. 102(b) as being anticipated by Marcovecchio (6,223,078). Applicant respectfully disagrees with the rejection.

As amended, claims 7 and 12 include, in part, "b) a calculating means which receives the biosignals, calculates a plurality of signals for stimulation of an organism using a convolution

integral between at least one impulse response previously obtained from normal biological activities and the biosignals, and outputs the signals for stimulation of the organism; wherein the impulse response is calculated from an inverse Fourier transform of a transfer function which is based on a Fourier transform of the biosignals".

The present invention is characterized by mimicking the stimulation (output) signals imposed on biological tissues by those elicited by the native organism. This is accomplished by calculating the output signal by the convolution between the impulse response (responsiveness of the native organism to the input signal) and the corresponding input biosignal. The impulse response is preferably obtained beforehand, by the inverse Fourier transform of the transfer function, which in turn is obtained by dividing the Fourier transformed output signal by the Fourier transformed input signal.

The impulse response quantifies the biological responsiveness (the relationship between output and input) rather than the biosignal itself or information derived from a single biosignal. The impulse response quantifies the relationship between at least two biosignals. The meaning, the dimension, and the unit of the impulse response may therefore differ considerably from those of the biosignal itself. Because the convolution is used to predict the output signal, the calculation is preferably performed between impulse response and the corresponding input signal.

In contrast, in Marcovecchio, although a convolution calculation was performed, it was not a calculation performed to predict an output signal. In fact, the convolution in Marcovecchio does not involve the impulse response (biological responsiveness).

More specifically, Marcovecchio calculates convolution between an ECG feature point vector (a set of information derived from the biosignal) and a filter, which was derived directly from the ECG feature point vector itself. The filter was derived just by reversing and shifting the sequence of the ECG feature point vector of an average normal ECG signal. The feature point vector of the unclassified ECG signal is then convolved with the filter. Marcovecchio uses the convolution between the ECG feature point vector and a filter directly obtained from the ECG feature point vector.

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The filter described in Marcovecchio, however, is just the order-reversed and element-shifted version of the ECG feature point vector itself. Therefore, both vectors are essentially the same information. This is very different than the convolution in claims 7 and 12, where input is convolved with the impulse response (not being a biosignal itself rather being input-output relation) quantifying the biological responsiveness.

In fact, the calculations used in Marcovecchio can be more appropriately expressed as the cross-correlation between two ECG feature point vectors. By reversing the order of elements in one of the vectors, cross-correlation operation would become apparently the same as convolution. Cross-correlation operation has been used to detect the similarity of two signals, therefore would be appropriate for the discrimination between supraventricular (more similar to sinus rhythm) and ventricular (dissimilar) arrhythmias.

The present invention enables a precise prediction of the native response to the input signal. The effect of predicting and mimicking the native biological response by an artificial device is not disclosed in Marcovecchio.

While calculations were performed in both the present invention and Marcovecchio, they are in reality quite different from each other. The difference arose from the completely different convolved signals or properties disclosed in Marcovecchio than what is claimed in the present invention. In addition, the present invention, as claimed in claims 7 and 12, enables an excellent effect to predict and mimic the stimulation signal, which should be outputted by the native organism in response to the input signal, i.e., the predicted demand of the native organism.

Therefore, it is respectfully suggested that the rejection of independent claims 7 and 12 as being anticipated by Marcovecchio is overcome. Dependent claims 8-10, being dependent upon and further limiting independent claim 7, should also be allowable for that reason, as well as for the additional recitations they contain. Reconsideration and withdrawal of the rejection are respectfully requested.

13. Claim 11 was rejected under 35 U.S.C. 102(b) as being anticipated by Marcovecchio.
    Applicant respectfully disagrees with the rejection. The argument regarding the anticipation of claim 7, upon which claim 11 depends, is repeated herein by reference.

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As discussed above, claim 7 is not anticipated by Marcovecchio. Claim 11, being dependent upon and further limiting independent claim 7, should also be allowable for that reason, as well as for the additional recitations it contains. Reconsideration and withdrawal of the rejection of claim 11 are respectfully requested.

Rejection under 35 U.S.C. §103

13. Claim 11 was rejected under 35 U.S.C. 103(a) as being unpatentable over Marcovecchio. Applicant respectfully disagrees with this rejection. The argument regarding the anticipation of claim 7, upon which claim 11 depends, is repeated herein by reference.

As amended, claim 7 includes, in part, "b) a calculating means which receives the biosignals, calculates a plurality of signals for stimulation of an organism using a convolution integral between at least one impulse response previously obtained from normal biological activities and the biosignals, and outputs the signals for stimulation of the organism; wherein the impulse response is calculated from an inverse Fourier transform of a transfer function which is based on a Fourier transform of the biosignals".

The present invention is characterized by mimicking the stimulation (output) signals imposed on biological tissues by those elicited by the native organism. This is accomplished by calculating the output signal by the convolution between the impulse response (responsiveness of the native organism to the input signal) and the corresponding input biosignal. The impulse response is preferably obtained beforehand, by the inverse Fourier transform of the transfer function, which in turn is obtained by dividing the Fourier transformed output signal by the Fourier transformed input signal.

The impulse response quantifies the biological responsiveness (the relationship between output and input) rather than the biosignal itself or information derived from a single biosignal. The impulse response quantifies the relationship between at least two biosignals. The meaning, the dimension and the unit of the impulse response may therefore differ considerably from those of the biosignal itself. Because the convolution is used to predict the output signal, the calculation is preferably performed between impulse response and the corresponding input signal.

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Marcovecchio does not teach or suggest a calculation performed to predict an output signal. In fact, the convolution in Marcovecchio does not involve the impulse response (biological responsiveness).

More specifically, Marcovecchio calculates convolution between an ECG feature point vector (a set of information derived from biosignal) and a filter, which was derived directly from the ECG feature point vector itself. The filter was derived just by reversing and shifting the sequence of the ECG feature point vector of an average normal ECG signal. The feature point vector of the unclassified ECG signal is then convolved with the filter. Marcovecchio uses the convolution between the ECG feature point vector and a filter directly obtained from the ECG feature point vector.

The filter described in Marcovecchio, however, is just the order-reversed and element-shifted version of the ECG feature point vector itself. Therefore, both vectors are essentially the same information. This is very different than the convolution in claim 7, where input is convolved with the impulse response (not being a biosignal itself rather being input-output relation) quantifying the biological responsiveness.

In fact, the calculations used in Marcovecchio can be more appropriately expressed as the cross-correlation between two ECG feature point vectors. By reversing the order of elements in one of the vectors, cross-correlation operation would become apparently the same as convolution. Cross-correlation operation has been used to detect the similarity of two signals, therefore would be appropriate for the discrimination between supraventricular (more similar to sinus rhythm) and ventricular (dissimilar) arrhythmias.

The present invention enables a precise prediction of the native response to the input signal. The effect of predicting and mimicking the native biological response by an artificial device is not taught or suggested in Marcovecchio.

Therefore, it is respectfully suggested that claim 7 is not obvious over Marcovecchio.Dependent claim 11, being dependent upon and further limiting independent claim 7, should also be allowable for that reason, as well as for the additional recitations it contains. Reconsideration and withdrawal of the rejection are respectfully requested.

Conclusion

Applicant believes the claims, as amended, are patentable over the prior art, and that this case is now in condition for allowance of all claims therein. Such action is thus respectfully requested. If the Examiner disagrees, or believes for any other reason that direct contact with Applicants' attorney would advance the prosecution of the case to finality, he is invited to telephone the undersigned at the number given below.

"Recognizing that Internet communications are not secured, I hereby authorize the PTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record in the application file."

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Dated: April 30, 2008